with the observed $A^{1/3}$ variation of the meson production cross section, which extends even to light nuclei—a variation difficult to understand on the basis of the known mean free path for absorption of mesons.

Levinger's calculations could now be remade on the basis of the present model. The changes would be to replace his $\sin^2\theta$ angular distribution of the deuteron disintegration by an isotropic distribution and to change the absolute cross section and its variations with energy. All of these changes would be in the direction to bring his results in better conformity with experiment. The actual calculations should await accurate measurements of the deuteron disintegration, which should be forthcoming shortly. Occasionally three nucleons and a meson will be within the interaction volume. This will happen in nuclear matter about one-third of the time, but it too should be included in the calculation. The probability of re-emission of the meson from the two nucleon system increases roughly as the square of the energy, and hence, this process too becomes important at higher energies.

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The Condensation Phenomenon of an Ideal Einstein-Bose Gas

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THE well-known statistical conclusions concerning the "condensation phenomenon" of an ideal Einstein-Bose gas are not only of independent theoretical interest, but have gained additional importance through attempts to base on them explanations for the superfluidity effects observed with He II.[1]

The ideal E.-B. gas below the "condensation temperature" is looked upon as being composed of essentially two phases, both of which fill the accessible volume uniformly; one phase is thought to consist essentially of gas particles of zero energy, while the other behaves similarly to an E.-B. gas above the condensation temperature. The equilibrium shifts very rapidly in favor of the first-mentioned condensed phase if below the condensation temperature, density is increased or temperature lowered. To distinguish from ordinary condensation one talks about condensation in the momentum space.

A renewed investigation of these statistical results leads to a revision of some accepted views. It can be shown that by proper introduction of the energy levels occurring in an ideal gas one arrives, on account of the zero point energy, at a distribution law over the various states of momentum which is not the same as that given in reference 1. This, by itself, constitutes only a quantitative change which otherwise does not affect the general conclusions.

One encounters, on the other hand, essential modifications in the study of an ideal E.-B. gas in the earth's gravitational field, hereby approaching real conditions more closely. Again, we find a separation into two phases as described before. But now the condensed phase no longer occupies the total accessible volume; it is essentially confined to a very thin layer at the bottom of the vessel. To fix ideas: 2×10^{22} atoms of He, looked upon for the moment as constituting an ideal gas at 2°K and contained in a cube of 1 cm³ volume, would form a film on the bottom about 10^{-3}-cm thick. Analytically, the ratio determining the "barometer formula" of the ideal condensed phase is no longer mgz/kT but mgz/ϵ_i, where ϵ_i denotes the energy of the quantum state under consideration; in the present case this will be essentially the zero point energy in the gravitational field.

The density of such an ideal "condensed" He gas reaches values of the order of 100 g/cm³. Experience shows that liquid He is formed by the interatomic forces at densities of the order of 10^{-1} g/cm³; the interatomic distance in the ideal "condensed" gas phase would be about as small as the Bohr radius of He. Obviously, such an ideal condensed gas could never be realized; long before the conditions for its existence are satisfied the interatomic forces will become predominant and make the gas strongly nonideal.

The ideal condensed gas is still described by eigenfunctions corresponding to the lowest momentum state in the plane perpendicular to the gravitational field. This condition obviously cannot be preserved in the presence of interatomic forces; how far it persists approximately can only be decided with the aid of a theory of the liquid state.

The difference in the behavior of He^3 and He^4 strongly suggests that E.-B. statistics play a fundamental roll as far as superfluidity is concerned. Still, care seems indicated in the use of analogies based on effects occurring in ideal E.-B. gases, since the interatomic forces apparently influence the phenomena qualitatively.

A more detailed paper will follow.

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The Photodissociation of the Helium Nucleus by High Energy Gamma-Rays

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THE photodissociation of alpha-particles by high energy synchrotron gamma-rays of a maximum energy of 320 Mev was studied by the previously reported[1] method used in the study of the photodissociation of the deuteron. The analysis was made on the proton tracks found in photographic emulsion exposed to the secondary particles emitted from a gas target of helium. The exposure had been made originally by Jakobsen *et al.*,[2] to investigate the photomeson production in the helium nucleus. Because of the fairly large experimental error, the conclusions are not entirely free from ambiguities. It seems, however, difficult to get more accurate results before the intensity of the synchrotron beam

TABLE I. Energy spectra of the protons in the photodissociation of the deuteron and the α-particle, at emission angles of 45°, 90°, and 135°.

Angle	Energy (Mev)	Deuteron	α-particle
45°	78		26.2±2.9
	80	18.7±1.7	
	87	15.6±1.6	
	93	9.0±1.4	17.7±2.0
	99	12.3±2.5	
	103	8.6±1.5	17.4±2.1
	116	6.8±1.2	
	126	7.3±1.3	
	141	5.8±1.3	
	154		6.4±1.3
	165		5.5±1.4
	177	6.7±1.6	
	189	8.5±1.6	
	205	3.5±1.8	6.4±1.4
	216	2.3±1.6	2.8±1.2
	241		3.3±1.5
	258		1.9±1.1
	320	2.6±1.1	
90°	68		11.7±1.7
	72	5.2±0.8	
	80	4.1±0.8	
	86	3.9±0.8	7.3±1.1
	93	4.8±1.0	
	99	6.3±1.3	9.0±1.6
	108	5.9±1.6	6.5±1.2
	117	5.7±1.7	6.0±1.3
	125	3.7±1.4	
	132	2.4±1.2	3.9±0.9
	143	2.1±0.7	
	161	0.67±0.47	
	172		1.3±0.4
	182	1.2±0.7	
135°	84		4.5±0.9
	86	3.7±0.8	3.5±0.8
	92	3.4±0.8	3.5±0.8
	98	2.7±0.8	5.6±1.0
	103	2.8±0.9	3.6±1.2
	116	0.6±0.4	2.9±0.8
	122		2.2±0.7
	127		1.6±0.6
	134		1.3±0.6
	140	1.7±0.7	1.1±0.4